

A REVOLUTION IN

DIAMOND PRE-CONCENTRATION



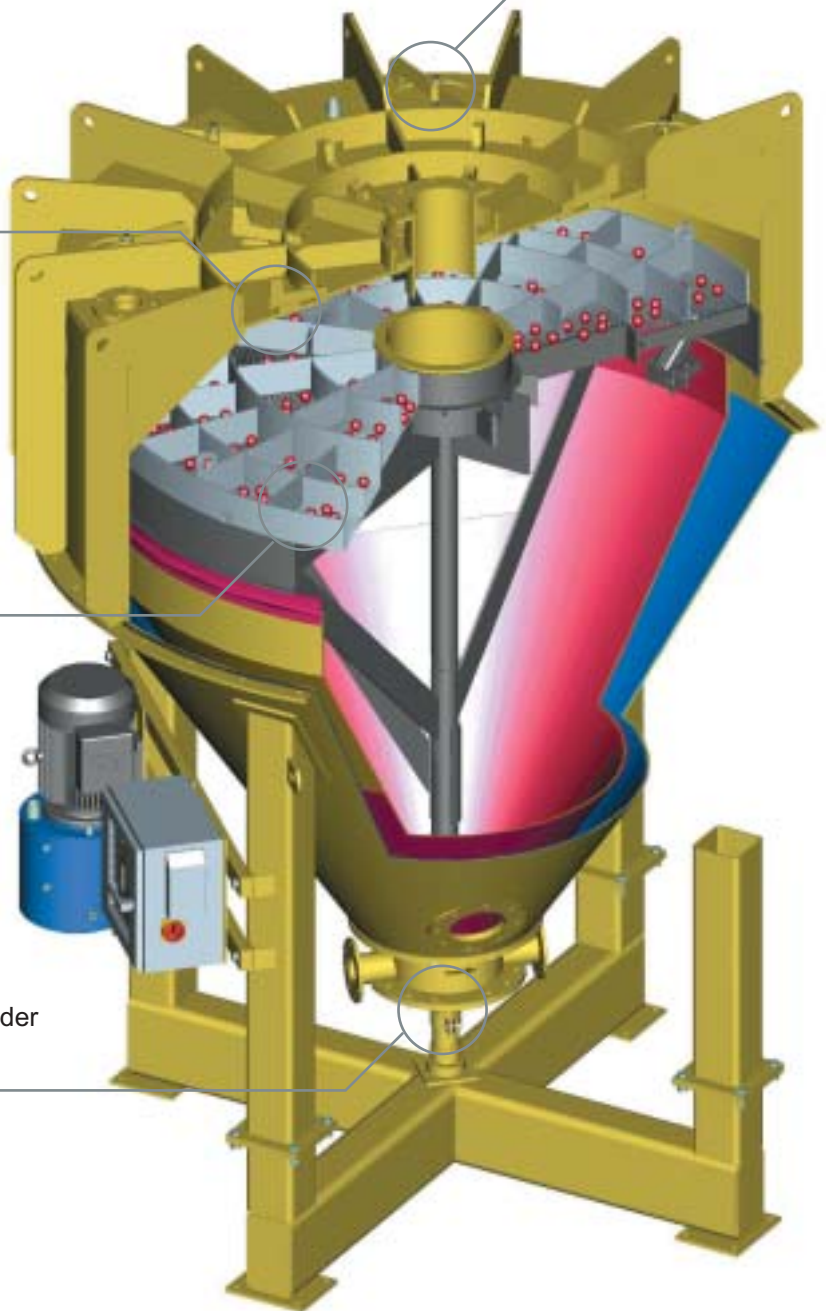
GEKKO
SYSTEMS

High efficiency pressurised design pre-concentrates diamond feed for as little as **US\$ 0.01 per ton** operating cost

Lockable inspection hatches for **High Security**

Unique ragging for **Sharper Cut Points**

Single hydraulic cylinder for **High Availability**



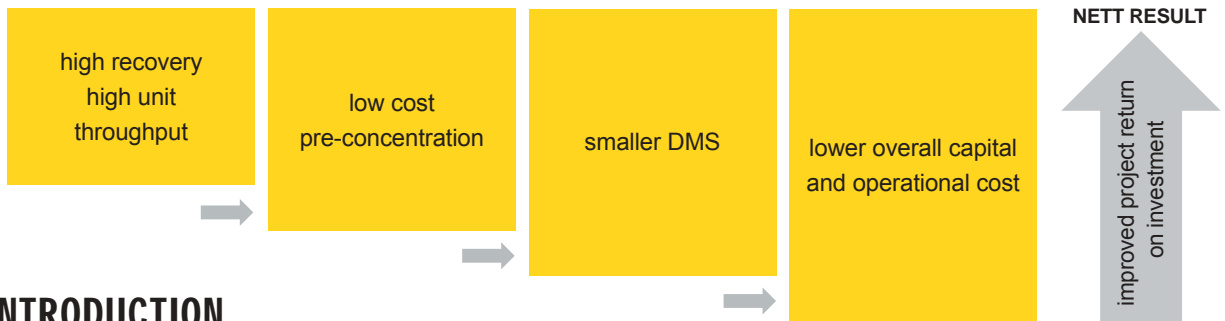
The pre-concentration of ore to significantly reduce operating costs is an old concept that is being seen in a new light by diamond metallurgists since the introduction of Gekko Systems' InLine Pressure Jig (IPJ) into the diamond recovery industry. The IPJ's capacity to reject a high proportion of waste material whilst maintaining recovery of diamonds allows significant size reduction of the downstream DMS recovery unit.

INLINE PRESSURE JIG





UNIQUE BENEFITS OF IPJ INSTALLATION



INTRODUCTION

The InLine Pressure Jig is a compact, low cost continuous gravity recovery device that requires minimal infrastructure or logistical support. In addition to its low capital cost, it has very low operating costs per volume treated, and very low power consumption. Hutch water can be supplied from the ocean, rivers, boreholes, thickener overflow or slimes dam return and can contain

up to 1-2% w/w solids content without adversely affecting jig performance. The IPJ requires as little as 10% of the water consumption of traditional jigs. There are currently over 100 IPJ's in operation around the World, many in Africa treating a variety of minerals, including a high proportion currently used in diamond applications.

SPECIFICATIONS

	Model			
Specifications	600	1000	1500	2400
Maximum to feed (tph)	2	15	40	85
Maximum particle feed size (mm)	6	22	22	22
Hutch water typical (m ³ /hr)	0.1-0.5	5-20	10-70	15-100
Typical yields to sinks/concentrate (tph)	0.6	4.0	8.0	20.0
Feed flowrate (m ³ /hr)	0-8	0-60	0-100	0-200

UNIQUE FEATURES

HIGH PRECISION RAGGING

The newly designed Gekko 'polymer ragging' enables clients to 'sharpen' the jig cut point offering metallurgical, financial and technical benefits over traditional natural ragging. The spherical synthetic ragging can be made to any size and density offering flexibility for different applications and feed sizes.



The ragging is made from a heavy polymer to enable a long wear life, therefore the spherical shape is sustained. Current standard ragging sizes range from 3.5mm to 32mm. The ragging can also be made to order in different densities.

TRACERS

The Gekko 'magnetic polymer' tracers offer process engineers/metallurgists a cheap solution for auditing diamond circuits. The tracers are made to a specific gravity (SG) of 3.5 (equivalent to the SG of diamonds) and can be added to the circuit and recovered by magnets. The tracers do not wear significantly and can be recovered for re-use. Tracers can be made to order in different densities and sizes as required.

CIRCULAR BED, PRESSURISED UNIT, SAWTOOTH PULSE

The unique combination of features, which includes a pressurised separation zone, moveable circular screen bed and adjustable sawtooth pulse, have resulted in a significant improvement in jig performance. The outcome is a less turbulent, lower velocity separation process which results in a step change improvement in jig recovery and efficiency.

SCREENS

All internal screens are manufactured from stainless steel wedge wire, with two different geometries available; slotted wedge wire and circular wedge wire. The circular wedge wire screen has been designed specifically for diamond applications by Gekko Systems following discussions with DeBeers (DebTech). The circular wedge wire design prevents any feed particles from hanging up in the 'bed' improving recovery and security. The design also helps reduce the residence time of diamonds in the system.

ALLUVIAL

MARINE

KIMBERLITE



APPLICATIONS

MARINE

Coastal concessions include deep-water, surf-zone and beach deposits where large proportions of shell are found combined with the gravels. Shell removal is considered to be of the highest priority due to 'gastropod' shape and absorption of ferrosilicon resulting in losses of up to 5kg/t treated. The IPJ is successfully employed ahead of DMS treatment for shell removal and pre-concentration of gravel resulting in lower ferrosilicon consumption and a reduction in operating costs. Gekko Systems supply 'marinised' IPJ's rated for coastal conditions and are designed to ensure the unhindered passage of diamonds through the unit.



ALLUVIAL

Typically operators of small-scale mines work in remote regions often situated on riverbanks. Equipment is required to be mobile and simple to operate. Diamond pan plants are often employed for primary gravity separation. Fear of diamond loss results in an abnormally high ratio of concentrate to waste, which hinders the diamond sorting process further downstream.

The IPJ is capable of producing a low mass pull to concentrate without diamond loss, which results in more efficient final diamond sorting. The equipment is compact using less water than conventional gravity separation devices with the added advantage of a sealed lid for security.

TAILINGS

Tailings from conventional hard rock diamond recovery plants and alluvial gravels can often contain valuable diamonds. This is generally attributed to poor process control with earlier treatment processes often employing diamond pans or other manual techniques.

The re-treatment of tailings is economically justified when large volumes of tailings can be efficiently processed resulting in a diamond-rich concentrate of low mass which is then sent to DMS or the diamond sorting process. Recent tests have shown a 100% recovery of diamond tracers, reporting to a concentrate comprising only 10% of the total mass fed to the IPJ.

KIMBERLITE

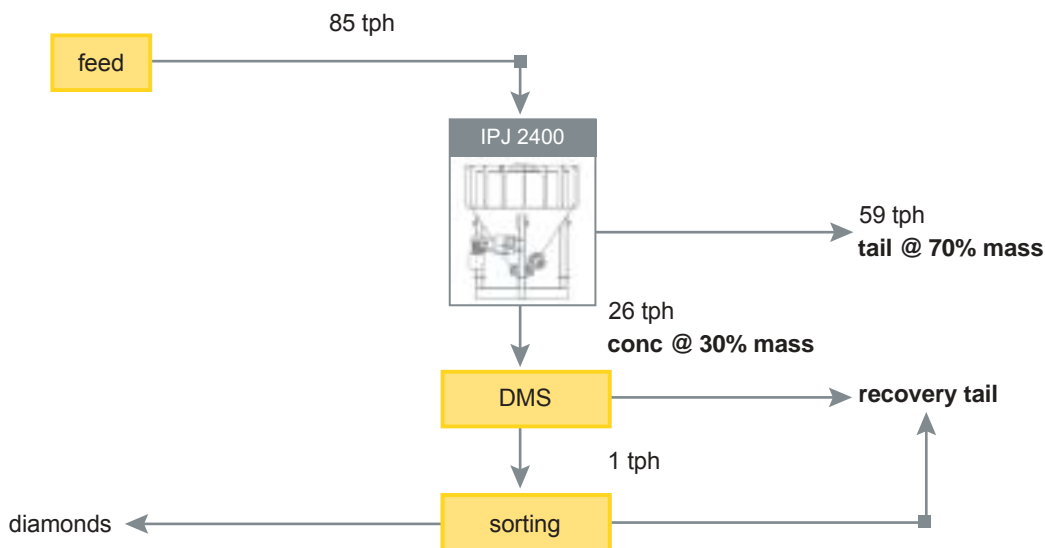
The pre-concentration of freshly mined kimberlite has the potential to reduce the size of DMS plant required in a greenfields installation. Alternatively retrofit into an existing installation has the potential to almost treble fresh ore feed. Recent plant operations have proven this with no significant loss of tracers.

EXPLORATION

Diamond exploration requires the use of cost effective mobile equipment for ease of transport and installation. Water conservation is important since this is not always readily available. Typically a rotating trommel and vibrating screen are used ahead of a pilot 5 t/h DMS plant. The IPJ could be employed ahead of DMS or X-Ray sorting devices to prepare a low volume/diamond rich concentrate feed. Gekko Systems have designed and supplied skid-mounted mobile plants for exploration purposes where two stages of jiggling are employed. The 1st stage IPJ acts as a pre-concentrator, delivering a medium grade feed to the second stage 'cleaner' IPJ. The cleaner IPJ upgrades the concentrate and produces a feed suitable for X-Ray sorting.



TYPICAL FLOW SHEET





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ADVANTAGES

Water consumption	The IPJ's low water requirement means that its applicability in water sensitive areas is improved. In arid areas the availability of water can severely limit the use of gravity treatment options. In addition the fact that no reagents or other media are added to the process, means that excess water can be returned to natural water courses without environmental impact.
High yield, high recovery	As a continuous concentrate discharge unit, the IPJ offers a high degree of flexibility. Mass pull to concentrate can be varied from 0.5% up to 30% to optimise recovery for a particular application.
Wide range and particle size recovery	Feed sizing of up to 22mm is acceptable. In many circumstances this may eliminate the requirement for an additional screening step.
Cost savings	The design of the InLine Pressure Jig is very efficient for the volume treated. In addition, due to the low wear rate and low power consumption, operating costs are extremely low. As a result, capital and operating cost savings can be significant
Mobility	Due to its compact design and minimal peripheral equipment requirement, the IPJ is extremely mobile.

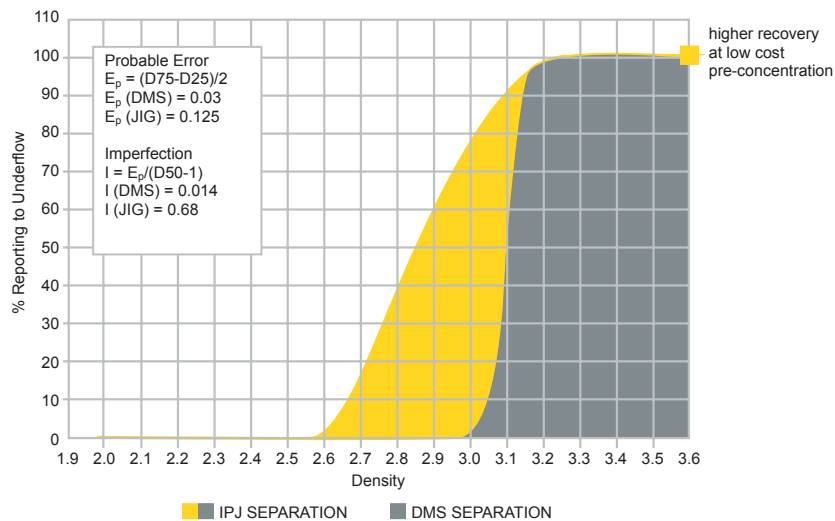
JIG PERFORMANCE

The Partition (E_p) curve, shown at right, indicates that the IPJ will recover 100% of 3.2SG and higher particles to sinks. This is also true for DMS technology.

The chart also demonstrates that the DMS recovers a lower mass, at a more accurate cut point - however the downside is that the unit is significantly more expensive to operate and purchase. The IPJ does not cut as accurately but will remove a higher proportion of gangue (waste) with minimal losses and at a lower cost. This provides the ultimate pre-concentration step ahead of conventional recovery. Together the two units provide a complementary recovery and cost outcome.

The volume of material reporting to concentrate (sinks) for the IPJ is shown by the area under the E_p curve coloured in yellow and grey. The volume of material taken to sinks by the DMS is shaded in grey only. The area between the two curves,

IPJ AND DMS PARTITION CURVES

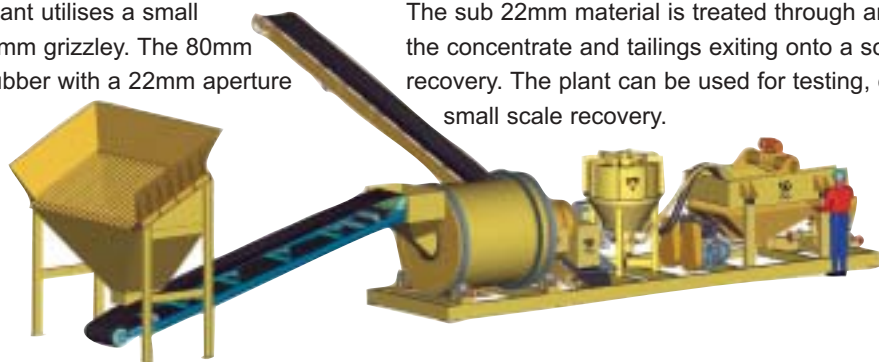


shaded in yellow only, indicates the mass of material that will report to DMS tails from the IPJ concentrate. Importantly the chart indicates that the IPJ doesn't cut into the DMS separation zone.

SYSTEMS SOLUTIONS

Gekko Systems' pilot plant utilises a small feed hopper with an 80mm grizzly. The 80mm feed is treated in a scrubber with a 22mm aperture trommel screen.

The sub 22mm material is treated through an IPJ1000 with the concentrate and tailings exiting onto a screen for tracer recovery. The plant can be used for testing, exploration or small scale recovery.





DIAMOND IPJ SPECIFICATIONS

INLINE PRESSURE JIG



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SPECIFICATIONS

	UNIT	MODEL			
		600	1000	1500	2400
DIAMOND IPJ SPECIFICATION					
Feed flowrate	m ³ /hr	0-10	0-60	0-100	0-200
Solids feed rate (max)	tph	2	15	40	80
Maximum feed size	mm	6	22	22	22
Concentrate flowrate	m ³ /hr	2-5	2-15	2-50	2-80
Concentrate production	tph solids	0.03-0.6	0.5-5	1-15	5-20
Tailings flowrate	m ³ /hr	2-12	10-70	20-130	40-260
Speed motor	rpm	1440	1440	1440	1440
Maximum operating pressure	kPa	100	200	200	200
Operating pressure	kPa	10-100	40-200	40-200	40-200
Hutch water requirements	m ³ /hr	0.1 - 0.5	10 - 30	15 - 50	25 - 120
Hutch water typical	m ³ /hr	0.3	15	25	50
Water supply pressure	kPa	350	350	350	350
Water inlet fitting*	mm	25	50	50	100
Feed pipe*	mm	50	100	150	200
Tailings fitting*	mm	50	100	150	150
Concentrate outlet*	mm	40	50	50/80	100
Minimum Concentrate velocity	m/s	3.5	3.5	3.5	3.5
Pulse rate	cyc/min	80-200	80-200	50-250	50-250
Stroke length#	mm	3-20	3-20	3-20	3-20
Pulse wave form		Sawtooth/Variable	Sawtooth/Variable	Sawtooth/Variable	Sawtooth/Variable
Hydraulic pressure	kPa	2500-10000	2500-10000	2500-10000	2500-10000
Total transport mass	kg	500	1600	1900	4100
Cover weight	kg	100	500	600	1400
Installed power	kW	1.5	1.5	2.2	4
	Volt	240/415	415/660	415/660	415/660
Internal volume	m ³	250	1000	1600	4900
Ragging requirements					
Polyurethane 35mm	kg	22	42	70	165
Polyurethane 22mm	kg	18	35	55	125

* Flange sizes shown are AS2129 standard. NOTE: Size and type of flanges can be supplied to suit site requirements.

Long stroke available~35mm.

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DIAMOND IPJ FEATURES AND BENEFITS

INLINE PRESSURE JIG



ADVANTAGES

- Pre-concentration:** significant cost savings can be realised as a result of reduced downstream volumes.
- Increased downstream plant capacity:** due to the upfront removal of waste products.
- Low cost throughput:** operating costs below US\$0.02 per ton treated.
- Flexibility of downturn ratio:** mass pull can be varied with changing ore conditions.
- Simple design:** no complicated operations required.
- Lower capital cost:** compared with alternative technology.
- Modular design:** plant can be extended as throughput requirements change.
- Recoveries:** mass pull can be changed to optimise diamond recovery.
- Moving platform suitability:** ideal for installation in a mobile/shipboard application.
- Security:** fully enclosed operation reduces access to diamondiferous material.

PRODUCT FEATURES AND BENEFITS

PRODUCT FEATURES	PRODUCT BENEFITS
Paint applied to amerloc standard	Inhibits corrosion and increases unit life
Stainless steel wedge wire screens	Low diamond hang up, increased open area
Double thickness rubber lining	High wear resistance
Lockable inspection hatch	Increased security
Low aspect ratio synthetic ragging - available in many sizes and densities	Provides sharper cut point, and allows fine tuning of separation
Larger hutch spool	Reduces diamond hang up and reduces potential for blockages
Minimal moving parts	Low maintenance, low power consumption, efficient operation
Robust steel construction	Ideal for harsh plant environment
Control panel to IP66, weather protection standard	Prevents rain water ingress and control circuit damage
Robust hydraulic system	Low maintenance, simple to maintain and operate
Hutch water flow meter	Low water requirement
Adjustable pulse cycle and sawtooth profile	Easy to optimise settings under changing ore conditions
OPTIONAL EXTRAS	
Automatic dump valve system	Empties jig on shutdown, improving product discharge and minimising risk of blockages
Jet pump feed and product discharge	Increases line velocities and reduces risk of blockage
Tangential tails flushing jets	Increases line velocity and reduces risk of blockage
DCS/SCADA Control	Single remote operator
Remotely Controlled operation	Keeps control circuits out of weather areas
MARINE SPECIFICATION OPTIONS	
Additional paint thickness	To extend life and provide additional corrosion protection in the harsh marine environment
Stainless steel shaft and screen frame	
Fully enclosed controls	
Fully enclosed hydraulic circuit	

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DIAMOND IPJ INSTALLATIONS

INLINE PRESSURE JIG



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TESTIMONIALS

“We were extremely impressed with how easy it was to operate the IPJ’s and that it made a difference from the word “GO”. FeSi savings are huge. We have already installed this technology in our last project and we are continuously doing test work to explore the IPJ’s potential.”

Douglas H Davidson: Metallurgical Engineer - Namdeb

“The IPJ has allowed us to increase production at a lower unit cost. If it wasn’t for the IPJ we would not have been able to progress the project as rapidly”.

Miles Kennedy, CEO – Kimberley Diamonds (Ellendale)

“Since... the use of synthetic ragging, the jig has been working very well, I am very happy with the results we are now obtaining, we will definitely be looking into further applications for this technology within the group”

Colyn Purdon: Manager Metallurgical Projects – Trans-Hex Group

“We are optimistic that the jigs will enable the DMS plants to cope with the dredged material from troublesome areas”

Andre Louw: Executive Director – Marine Division – Trans-Hex Group

INSTALLATIONS

COMPANY	PROJECT	LOCATION	FEED	UNITS
Various	Various	RSA Coastal	Marine Gravel	2 x IPJ1500 1 x IPJ2400 2 x IPJ1500
Namdeb	FTP	Orange River	Marine Gravel	3 x IPJ2400
Trans-Hex*	De Punt Recovery Plant	RSA Coastal	Marine Gravel	1 x IPJ1500
Namdeb	Mobile Treatment Plant	Namibia	Beach Deposits	1 x IPJ1500
Namdeb*	Pocket Beaches	Namibia	Marine Gravel	1 x IPJ1500
Kimberley Diamonds	Ellendale	Australia	Kimberlites	1 x IPJ2400
DES*	Bongou	Central African Republic	Alluvial Gravel	2 x IPJ1000 2 x IPJ1500
Africa Gold & Diamonds*	Dump 7	Sierra Leone	Tailings	3 x IPJ1500 2 x IPJ2400
Williamson*	Jig Plant	Tanzania	Tailings	1 x IPJ1500 6 x IPJ2400
Cape Technikon		Cape Town		1 x IPJ600

*Currently being commissioned, on trial or awaiting installation.

KIMBERLEY DIAMOND COMPANY ELLENDALE DIAMOND PROJECT – AUSTRALIA

Located in the West Kimberley region of Western Australia this company has successfully trialled and then incorporated the InLine Pressure Jig into their stage one processing plant. De Beers reportedly recommended the InLine Pressure Jig to them. This has allowed the operation to increase planned stage ore throughput from an expected 500,000 tpa to 715,000 tpa at minimal additional capital cost.

Initial test-work was conducted using an IPJ 1500 onsite to remove organic material and possibly pre concentrate lamproite feed to the DMS plant.

Following the success of this test-work to remove organic material, further diamond tracer test-work was conducted. This test-work indicated that at a 30% mass yield the IPJ was capable of recovering +98% of the feed diamonds.



Based on the trial results an IPJ 2400 was incorporated into the production plant at Ellendale and doubled the initial expected feed rate of the existing DMS production plant.

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